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# Factors influencing the wearing of facemasks to prevent the severe acute respiratory syndrome among adult Chinese in Hong Kong

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## Abstract

**Background.** The global outbreak of the severe acute respiratory syndrome (SARS) in 2003 has been an international public health threat. Quick diagnostic tests and specific treatments for SARS are not yet available; thus, prevention is of paramount importance to contain its global spread. This study aimed to determine factors associating with individuals' practice of the target SARS preventive behavior (facemask wearing).

**Methods.** A total of 1329 adult Chinese residing in Hong Kong were surveyed. The survey instrument included demographic data, measures on the five components of the Health Belief Model, and the practice of the target SARS preventive behavior. Logistic regression analyses were conducted to determine rates and predictors of facemask wearing.

**Results.** Overall, 61.2% of the respondents reported consistent use of facemasks to prevent SARS. Women, the 50–59 age group, and married respondents were more likely to wear facemasks. Three of the five components of the Health Belief Model, namely, perceived susceptibility, cues to action, and perceived benefits, were significant predictors of facemask-wearing even after considering effects of demographic characteristics.

**Conclusions.** The Health Belief Model is useful in identifying determinants of facemask wearing. Findings have significant implications in enhancing the effectiveness of SARS prevention programs.

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**Keywords:** Health behavior; Prevention and control; Infection; Asian

## Introduction

A new and highly infectious disease in humans, the severe acute respiratory disease syndrome (SARS), has created a major public health threat in many countries. Within 2 months since its first appearance in Asia in mid-February of 2003, the World Health Organization (WHO) has already received reports of the outbreak of SARS in 26 countries on all five continents [1]. The clinical symptoms of SARS are nonspecific, including high fever, dry cough, breathing difficulties, muscle pain, and generalized weakness. The incubation period can last from 2 to 10 days, thus enables symptomless individuals to transmit the disease through either close person-to-person contact or travel from one city to another city in the world. The mortality rate of

SARS is about 3–10%. Only recently has the causative agent of this disease been found. The latest multicountry laboratory findings have confirmed that a new pathogen, a member of the coronavirus family never been seen in humans, is the cause of SARS [2]. However, the exact transmission route of the disease is still unknown, and quick diagnostic tests as well as specific treatments are also not yet available. Under these unknown circumstances, prevention is of particular importance in containing the global spread of this new infectious disease. This study aimed to examine factors affecting Hong Kong people's practice of preventive behaviors against SARS. Findings from this study would provide pertinent information in designing and implementing SARS prevention programs not only for Hong Kong, but for other countries as well.

Hong Kong was one of the hardest hit area during the global outbreak of SARS in 2003 and has accounted for almost 40% of the probable cases and deaths of SARS. At the beginning of the local outbreak of this disease in early March of 2003, mainly health care workers who treated the

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index patients were infected with the disease [3]. Very soon, new cases were reported among close contacts of known patients, and the disease then quickly spread to the community. Local health authorities have since stepped up various prevention and intervention activities against further spread of the disease [4]. At the community level, health authorities have launched large-scale public health education programs about the disease, issued preventive health guidelines to health care workers and the general public, suspension of classes for schools and universities, prompt isolation of infected individuals, and ordering of probable infected individuals to quarantine themselves at home for 10 days. At the individual level, health advice is given on ways to prevent contracting and spreading of SARS. The suggested SARS preventive behaviors include (1) maintaining good personal hygiene (covering nose and mouth with a tissue when sneezing or coughing and washing hands immediately afterward with liquid soap), (2) developing a healthy lifestyle with proper diet, regular exercises, adequate rest, and no smoking, (3) ensuring good ventilation at home and in the office, and (4) wearing facemasks, especially for those with respiratory tract infections or those caring for them. Despite all these efforts, an average of 40–50 new infected cases and about five deaths of SARS were reported daily. The disease continued to affect both health care workers, as well as individuals from the community until June 2003.

Researchers have argued that the practice of preventive behaviors by individuals is one of the most effective ways in disease prevention and health promotion [5–7]. With environmental and policies support, these individual preventive behaviors can pass on to effective population-level prevention efforts [8,9]. For example, public education and media campaigns that disseminate health messages and information, environmental manipulation that provide necessary facilities, and national policies that make available economic incentive or reimbursement can motivate many individuals in the community to practice the desired health behaviors. Thus, various psychosocial approaches, such as the Health Belief Model [10], the Theory of Reasoned Action [11], the Social Cognitive Model [12], the Protection Motivation Theory [13], and the Stages of Change Model [14], have been put forward to predict the practice of preventive behaviors at the individual level.

Among various psychosocial approaches, the Health Belief Model is one of the most widely used and provides the necessary conceptual framework for this study. This model postulates that the practice of preventive behaviors is a function of the degree to which individuals perceive a personal health threat and the perception that particular preventive behaviors will be effective in reducing the threat [10]. In applying this model to understand the practice of SARS preventive behaviors, perceived health threat refers to individuals' perception of their vulnerability to contracting SARS (perceived susceptibility) and that this disease has serious consequences (perceived severity). Individuals' be-

lief that the practice of the suggested SARS preventive behaviors will prevent SARS depends on (1) whether they think these preventive behaviors will be effective (perceived benefits), (2) whether the cost of undertaking these behaviors (perceived barriers) exceeds the benefits, and (3) whether there are any cues (cues to action) to trigger these behaviors. Cues to action can be internal, such as the perception of a body state, or external, such as the influence of mass media and social pressure.

There is ample support for the Health Belief Model in explaining individual practice of preventive behaviors. This model helps to predict the practice of preventive dental care [15], dieting for obesity [16], AIDS risk-reduction behaviors [17], breast self-examination [18–20], sunscreen use [21], and participation in a broad array of health screening programs such as obtaining a mammogram to screen for breast cancer [22–24] and undergoing genetic testing for cancer susceptibility [25,26]. Prevention programs that draw on this model to effect behavioral change have also yielded positive results in increasing various health behaviors to prevent dental problems [15], osteoporosis [27], and diabetes [28]. Overall, perceived benefits, perceived barriers, and perceived susceptibility are the three most powerful components of the Health Belief Model in influencing whether individuals practice different preventive behaviors [21,29,30]. It is also found that the actual risk of developing a disease is a much less important predictor of individual preventive behaviors than is perceived susceptibility [31].

Other than psychosocial predictors, there is also an accumulation of literature documenting the importance of associations between individuals' demographic characteristics and their practice of preventive behaviors [5,32–35]. In general, women and more affluent and better educated individuals are more likely to practice the suggested preventive behaviors. An inverted curvilinear relationship is found between age and practice of preventive behaviors. Typically, young children are often compliant in adopting various preventive behaviors, which tend to decline in adolescence and adulthood but improve again among older people. Findings in relation to marital status and ethnicity are inconclusive.

The purposes of this study were twofold. The first objective was to determine the rates of the target SARS preventive behavior in adult Chinese with different demographic background. Among various SARS preventive behaviors suggested by local and international health authorities, this study focused on the wearing of facemasks. This target preventive behavior was chosen for this study because it was specific to this disease and involved deliberate effort of individuals. Based on past related literature, it was expected that men, the younger age group, and individuals with low educational attainment would be less likely to wear facemasks. The second objective of this study was to test the efficacy of the Health Belief Model in predicting the practice of the target preventive behavior. Based on past related literature, it was expected that perceived susceptibility, perceived severity,

perceived benefits, perceived barriers, and cues to action were significant predictors of facemask wearing.

## Methods

### Study sample

This study was conducted between March 29 and April 1, 2003, in Hong Kong, when there was clear evidence that SARS had started to spread from health care workers in hospitals to the community. At the time of the study, the exact causative agent and route of transmission of the disease were still not yet fully known [3]. Local health authorities had since implemented enhanced infection control procedures in all hospitals and cohorting of SARS patients [4]. They had also stepped up communitywide SARS prevention and intervention activities.

Data for this study were obtained using a community telephone survey of adult Chinese (aged 19 and above) residing in Hong Kong during the specified period. Random-digit dialing of the local residential telephone directory for 2002 was used to select respondents. This directory covered all listed telephone numbers in all regions of Hong Kong, where over 90% of the households owned at least one or more telephone lines. Telephone surveys were conducted by trained telephone interviewers and took about 20 min. When telephones were busy or there was no answer, three follow-up calls on different time or dates were attempted before substituting a new telephone number. The response rate was 65%, and the sampling error was 3.1 percentage points.

A total of 1329 adult Chinese were surveyed, and their demographic information are summarized in Table 1. Compared to the 2001 Hong Kong population census data [36], the present sample included more women as well as individuals with university education and higher monthly personal income. Similar differences in demographic characteristics between telephone surveys and census data were also noted in previous local telephone surveys [37]. The present sample comprised 40.2% men and 59.8% women. About half of them aged between 30 and 49 years, 20.2% between 19 and 29 years, 14.7% between 50 and 59 years, and 18.4% were older than 60 years. Among them, 30% were single, 66% were currently married, and the remaining were either separated, divorced, or widowed. Slightly more than half of the respondents completed high school education and worked either full time or part time. Another 21.1% of the respondents were homemakers, 7.8% were students, 12.6% were retirees, and 5.2% were unemployed.

### Measures

#### Practice of wearing facemasks

Respondents were asked to indicate how often in the past week they wore facemasks to prevent contracting and

Table 1  
Demographic characteristics of respondents

Characteristics	Present sample ( <i>n</i> = 1329) %	Hong Kong census 2001 ( <i>n</i> = 6708389) %
Sex		
Male	40.2	49.0
Female	59.8	51.0
Age		
19–29 years	20.2	19.7
30–49 years	46.7	46.6
50–59 years	14.7	14.3
Above 60 years	18.4	19.4
Education		
Primary school	21.5	28.9
High school	54.7	54.6
University	23.8	16.5
Marital status		
Never married	30.0	31.0
Currently married	66.0	59.4
Separated/divorced/ widowed	4.0	9.6
Employment		
Full time/part time	53.3	61.4
Homemakers	21.1	–
Students	7.8	–
Retired	12.6	–
Unemployed	5.2	4.9
Personal monthly income		
Under US\$1000	14.3	23.4
From US\$1000– 2500	59.3	53.8
From US\$2501– 5000	20.0	16.5
Above US\$5000	6.4	6.3

spreading SARS. They responded with either “never,” “occasionally,” or “most of the time.” The first two responses were coded as “0” and the last response was coded as “1” for subsequent statistical analyses.

#### Perceived susceptibility

This was assessed by three items: (1) whether respondents felt vulnerable to contracting SARS, (2) whether they knew or had close contact with any individuals infected with SARS, and (3) whether they had respiratory infection syndromes such as sore throat, dry cough, fever, muscle ache, and shortness of breath. Respondents answered with “yes” or “no” responses, and affirmative responses were then summed to form a total score. High total scores represent respondents perceiving themselves as being highly susceptible to contracting SARS.

#### Perceived severity

Respondents indicated on two 4-point scales the degree to which they were fearful of SARS (1 as “not at all fearful” to 4 as “very fearful”) and worried that Hong Kong would become a quarantine city because of the widespread of SARS to the community (1 as “not at all worried” to 4 as “very worried”). High mean scores of

these two scales represent respondents perceiving SARS as having very severe adverse consequences.

#### Perceived benefits

Respondents were asked to indicate on a 4-point scale the degree to which they agreed wearing facemasks could prevent contracting and spreading SARS (1 as “strongly disagree” to 4 as “strongly agree”). High scores indicate respondents perceiving great benefits in wearing facemasks.

#### Perceived barriers

Respondents were asked to rate on two 4-point scales the degree to which they had difficulty in obtaining facemasks (1 as “not at all difficult” to 4 as “very difficult”) and the level of discomfort when wearing them (1 as “not at all uncomfortable” to 4 as “very comfortable”). High mean scores of these two items indicate respondents perceiving great barriers in wearing facemasks.

#### Cues to action

This was assessed by asking respondents to indicate on two 4-point scales the degree to which the local government and their family members encouraged them to wear facemasks (1 as “strongly disagree” to 4 as “strongly agree”). High mean scores of these two scales represent respondents having great awareness of environmental cues to wear facemasks.

#### Demographics

Respondents were also asked about their sex, age, educational attainment, marital status, and personal monthly income.

#### Data analysis

Statistical analyses in this study were conducted using SPSS 10.0 software. Descriptive statistics for demographic characteristics of respondents were generated and compared with the 2001 Hong Kong population census data (Table 1). The rates of wearing facemasks were determined for individuals with various demographic characteristics. Bivariate logistic regression analyses were then conducted to determine whether the practice of facemask wearing differed within each demographic characteristic (Table 2). A multivariate logistic regression analysis was also performed to test the Health Belief Model and to identify significant predictors of the target preventive behavior. Odds ratios (ORs) for each predictor were estimated from the logistic regression (Table 3). Demographic variables of the respondents were entered in the logistic regression first to control for their effects before testing the Health Belief Model. Then, predictor variables were entered simultaneously in the next block of the regression. The predictor variables consisted the five components of the Health Belief Model: perceived sus-

Table 2

Statistics for demographic characteristics and target preventive behavior

Characteristics	No. practicing preventive behavior/total	%	$\chi^2$ (df)	OR (95% CI)
Sex ( <i>n</i> = 1327)			26.80* (1)	
Male	281/533	52.7		1.00
Female	531/794	66.9		1.810 (1.445, 2.268)
Age ( <i>n</i> = 1327)			12.60* (3)	
19–29 years	142/269	52.8		1.00
30–49 years	383/620	61.8		1.445 (1.083, 1.930)
50–59 years	133/195	68.2		1.918 (1.305, 2.819)
Above 60 years	154/243	63.4		1.118 (1.086, 2.205)
Education ( <i>n</i> = 1308)			1.02 (2)	
≤Primary	169/280	60.4		1.00
High school	434/717	60.5		1.007 (0.759, 1.336)
College≥	198/311	63.7		1.523 (0.825, 1.605)
Marital status ( <i>n</i> = 1296)			36.97* (1)	
Single	191/395	48.4		1.00
Married	598/901	66.2		2.108 (1.656, 2.682)
Personal monthly income ( <i>n</i> = 636)			8.06 (3)	
Under US\$1000	42/91	46.2		1.00
From US\$1000–2500	229/377	60.7		1.805 (1.138, 2.863)
From US\$2501–5000	75/127	59.1		1.683 (0.978, 2.896)
Above US\$5000	28/41	68.3		2.512 (1.156, 5.460)

OR indicates odds ratio; CI, confidence interval.

\**P* < 0.01.

ceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action.

## Results

#### Rates of target preventive behavior

Overall, 61.2% of the respondents reported consistent wearing of facemasks to prevent contracting and spreading SARS. Table 2 summarizes rates of facemask wearing among respondents with different demographic background. Results of bivariate logistic regression analyses showed that respondents who were women [OR = 1.810; 95% confidence interval (CI) = 1.445, 2.268], who are aged between 50 and 59 years (OR = 1.918; CI = 1.305, 2.819), who had university education (OR = 1.523; CI = 0.825, 1.605), who were married (OR = 2.108; CI = 1.656, 2.682), and who earned more than US\$5000 per month (OR = 2.512; CI = 1.156,

Table 3  
Logistic regression results and odds ratios of target preventive behavior

Variables	Coefficient	SE	OR	95% CI	P
Sex	0.329	0.142	1.390	1.053, 1.835	0.020
Age	0.036	0.028	1.037	0.982, 1.095	0.194
Marital status	0.397	0.168	1.487	1.070, 2.067	0.018
Perceived susceptibility	0.946	0.247	2.575	1.586, 4.181	0.000
Perceived severity	0.162	0.131	1.176	0.909, 1.521	0.217
Perceived benefits	0.303	0.145	1.354	1.019, 1.800	0.037
Perceived barriers	0.123	0.124	1.131	0.887, 1.443	0.320
Cues to action	0.895	0.135	2.447	1.875, 3.194	0.000
Constant	−6.620	—	—	—	—

Number of observations = 1250.90, log-likelihood = 1228.53,  $\chi^2 = 100.86$  ( $P = 0.000$ ). OR indicates odds ratio; CI, confidence interval.

5.460) were more likely to wear facemasks to prevent SARS within their own demographic groups. Results also showed that sex ( $\chi^2 = 26.8$ ,  $P < 0.001$ ), age ( $\chi^2 = 12.6$ ,  $P < 0.001$ ), and marital status ( $\chi^2 = 36.97$ ,  $P < 0.001$ ) had significant subgroup differences in the target preventive behavior.

#### Testing the health belief model

A logistic regression with odds ratios was conducted to test the efficacy of the Health Belief Model in predicting the wearing of facemasks to prevent SARS. In block I, demographic factors of sex, age, and marital status were entered first to control for their effects. Results showed that this block was significant ( $\chi^2 = 40.23$ ,  $P < 0.001$ ). The five components of the Health Belief Model were entered in the next block, and they were significant in predicting facemask wearing, even after considering effects of demographic factors ( $\chi^2 = 100.86$ ,  $P < 0.001$ ). The final model of the logistic regression analysis is presented in Table 3. With the exception of perceived barriers, all estimated coefficients were in the expected direction. All odds ratios were above 1.0.

In summary, respondents who were women (OR = 1.39; CI = 1.053, 1.835), who belonged to the older age group (OR = 1.037; CI = 0.982, 1.095), who were married (OR = 1.487; CI = 1.07, 2.067), who felt more susceptible to contracting SARS (OR = 2.575; CI = 1.586, 4.181), who perceived SARS as having more serious consequences (OR = 1.176; CI = 0.909, 1.521), who believed greater benefits in wearing facemasks (OR = 1.354; CI = 1.019, 1.800), who encountered greater barriers in wearing facemasks (OR = 1.131; CI = 0.887, 1.443), and who were more aware of environmental cues (OR = 2.447; CI = 1.875, 3.194) were more likely to wear facemasks. Results showed that three of the five components of the Health Belief Model, namely, perceived susceptibility, cues to action, and perceived benefits, were significant predictors. Perceived severity and perceived barriers were not significant predictors of facemask wearing when other factors were also considered.

## Discussions

This study examined how various psychosocial factors are associated with the practice of the target SARS preventive behavior among adult Chinese in Hong Kong. Similar to previous research [15–26], this study found the Health Belief Model useful in identifying major determinants of the wearing of facemasks to prevent contracting and spreading SARS. In particular, findings showed that three of the five components of the model, namely, perceived susceptibility, cues to action, and perceived benefits, were significant predictors. Review studies of the Health Belief Model have also found that among the five components, perceived susceptibility and perceived benefits are the more powerful components in predicting preventive behaviors [29,30]. The present results showed that compared to those with a low level of perceived susceptibility, individuals feeling personally very vulnerable to contracting SARS were 2.5 times more likely to wear facemasks. It was also found that individuals who had strong beliefs in the effectiveness of wearing facemasks to prevent SARS were 1.4 times more likely to wear facemasks than those who did not have these beliefs. Furthermore, this study showed that cues to action were as an important predictor as perceived susceptibility. Those who were more aware of environmental cues were 2.4 times more likely to wear facemasks than those who perceived few cues to action. Previous studies have also indicated that cues to action in the form of advice from family members and health care professionals are also very important factors in increasing various preventive behaviors [23].

The remaining two components of the Health Belief Model, perceived severity and perceived barriers, were found to be nonsignificant determinants of the target SARS preventive behavior in this study. In spite of previous literature indicating the powerfulness of perceived barriers in influencing the practice of preventive behaviors [21,23,29,30], this component did not significantly predict the wearing of facemasks in the present sample of adult Chinese. It might be that this target preventive behavior is relatively easy to perform, despite some discomfort and inconvenience. Individuals can have complete control of the behavior and can take off the facemasks anytime they want or feel uncomfortable. Facemasks are cheap and easy to obtain, except during the early outbreak of SARS. Thus, there are relatively less perceived barriers in wearing facemasks as compared to participating in screening or immunization programs. This study also found that perceived severity of SARS did not significantly predict facemask wearing. Earlier studies on cancer noted that perceived severity was not related to preventive behaviors, as cancer is uniformly thought of as a serious disease [30]. On the other hand, it would also be argued that the failure of perceived severity to predict the target SARS preventive behavior might be related to individuals' underestimation of the potential of this disease to become a global epidemic. During the early stage of the local outbreak, this disease

affected mainly health care workers, a few index patients, and their close contacts [3]. The serious consequences of this disease with increasing prevalence and mortality rates might have been overlooked. Thus, the public was not motivated or did not anticipate the need to practice the suggested SARS preventive behavior.

Similar to existing literature on preventive behaviors [7,32–35], this study also found that individuals' demographic characteristics were significant predictors of facemask wearing. Results showed that men, single people, and the 19–29 age group were significantly less likely to wear facemasks to prevent SARS than women, married people, and individuals aged between 30 and 59 years. Although statistically nonsignificant, odds ratios also showed that individuals with less than university education and very low personal income were also less likely to wear facemasks. Researchers have argued that the low rates of preventive behaviors among young, single, and low education men may be related to their inadequate knowledge about the disease, peer influences, risk-taking tendency, and perceived immortality and immunity to various disease [5,38].

This study found that about 61.2% of the respondents consistently wore facemasks to prevent SARS. In other words, despite the rapid spread, increasing death toll, and vigorous preventive activities, close to 40% of the respondents did not practice the target SARS preventive behavior. For some subgroups, the noncompliance rates were even higher. As there are evidences that SARS may emerge again both locally and across countries [1], there is a need for Hong Kong, as well as other countries, to further enhance the effectiveness of related prevention and intervention measures to contain the disease. Results of this study had significant implications for SARS prevention programs. It is suggested that individuals' perception of their own vulnerability to the disease should be emphasized by highlighting the global outbreak and debilitating health consequences of SARS, which not only affect health care workers, older people, those with chronic illness, or individuals of a particular ethnicity. Public education and media campaigns should be conducted regularly in schools, workplaces, and community settings to disseminate the latest findings of SARS. The public should be made aware that there is no specific treatment and vaccination for this disease; therefore, individuals must take own precautions to prevent contracting the disease. It should also be emphasized that at the individual level, facemask wearing remains one of the most effective ways to prevent contracting and spreading SARS [39]. Indeed, studies have shown that communications that highlight perceived susceptibility and simultaneously increase the perception that a particular health behavior will reduce the health threat are successful in promoting various preventive behaviors [15,27,28]. The present study also showed that environmental cues to wear facemasks are very important. Other researchers have argued that environmental manipulation and policies support are crucial to translate

individual to collective preventive efforts [8,9]. Environmental cues can be in the form of signs and posters to remind people to wear facemasks and should be placed in prominent areas in schools, at worksites, and in public places. Advice, recommendation, or encouragement from health care professionals are also useful to increase individuals' likelihood to wear facemasks. Policies that require the wearing of facemasks in certain locations (e.g., inside hospitals) or for those who have respiratory symptoms will also ensure individuals to practice the desired preventive behaviors. Finally, it is also particularly important to target SARS prevention activities at those who are less likely to practice these behaviors, namely, men, single individuals, and the younger age group.

This study had several limitations. First, there were concerns about the representative of the sample. This study used telephone surveys to collect data and failed to include individuals who were without home telephone lines or not at home during the surveyed period. Comparison with the census data showed that the present sample comprised more women as well as more affluent and better educated individuals, who were also more likely to practice the suggested SARS behaviors. In view of this, the present sample might have higher rates of facemask wearing than the general population. Second, only retrospective self-reports of respondents were collected without external verification, and results might be subject to recall and social desirability bias. Third, this study focused on the five key components of the Health Belief Model to predict rates of facemask wearing. It did not investigate individuals' knowledge of and emotional responses to SARS, which have also been found to significantly influence the practice of preventive behaviors [23,40]. Lastly, the measurement of the target SARS preventive behavior was crude and without any contextual information. It is possible that rates of facemask wearing might differ at home, in the workplace, or in public places.

Despite these limitations, this study provided pertinent information on factors influencing the practice of the target SARS preventive behavior. Findings have significant implications in enhancing the effectiveness of prevention activities against the global spread of SARS.

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